

# PATENT COOPERATION TREATY

## PCT

### NOTIFICATION OF ELECTION

(PCT Rule 61.2)

From the INTERNATIONAL BUREAU

To:

Commissioner  
US Department of Commerce  
United States Patent and Trademark  
Office, PCT  
2011 South Clark Place Room  
CP2/5C24  
Arlington, VA 22202  
ETATS-UNIS D'AMERIQUE  
in its capacity as elected Office

Date of mailing (day/month/year)  
27 June 2001 (27.06.01)

International application No.  
PCT/GB00/03905

Applicant's or agent's file reference  
140058

International filing date (day/month/year)  
11 October 2000 (11.10.00)

Priority date (day/month/year)  
20 October 1999 (20.10.99)

Applicant

CHAPMAN, Barry, Leonard, Walter

1. The designated Office is hereby notified of its election made:

☒ in the demand filed with the International Preliminary Examining Authority on:  
27 April 2001 (27.04.01)

☐ in a notice effecting later election filed with the International Bureau on:

2. The election ☒ was  
☐ was not

made before the expiration of 19 months from the priority date or, where Rule 32 applies, within the time limit under Rule 32.2(b).

The International Bureau of WIPO  
34, chemin des Colombettes  
1211 Geneva 20, Switzerland

Authorized officer

Olivia TEFY

Facsimile No.: (41-22) 740.14.35

Telephone No.: (41-22) 338.83.38

# PATENT COOPERATION TREATY

# PCT

## INTERNATIONAL SEARCH REPORT

(PCT Article 18 and Rules 43 and 44)

Applicant's or agent's file reference <b>140058</b>	<b>FOR FURTHER ACTION</b> see Notification of Transmittal of International Search Report (Form PCT/ISA/220) as well as, where applicable, item 5 below.	
International application No. <b>PCT/GB 00/ 03905</b>	International filing date (day/month/year) <b>11/10/2000</b>	(Earliest) Priority Date (day/month/year) <b>20/10/1999</b>
Applicant  <b>BTG INTERNATIONAL LIMITED</b>		

This International Search Report has been prepared by this International Searching Authority and is transmitted to the applicant according to Article 18. A copy is being transmitted to the International Bureau.

This International Search Report consists of a total of 3 sheets.  
☒ It is also accompanied by a copy of each prior art document cited in this report.

**1. Basis of the report**

a. With regard to the **language**, the international search was carried out on the basis of the international application in the language in which it was filed, unless otherwise indicated under this item.

☐ the international search was carried out on the basis of a translation of the international application furnished to this Authority (Rule 23.1(b)).

b. With regard to any **nucleotide and/or amino acid sequence** disclosed in the international application, the international search was carried out on the basis of the sequence listing :

☐ contained in the international application in written form.

☐ filed together with the international application in computer readable form.

☐ furnished subsequently to this Authority in written form.

☐ furnished subsequently to this Authority in computer readable form.

☐ the statement that the subsequently furnished written sequence listing does not go beyond the disclosure in the international application as filed has been furnished.

☐ the statement that the information recorded in computer readable form is identical to the written sequence listing has been furnished

2. ☐ **Certain claims were found unsearchable** (See Box I).

3. ☐ **Unity of invention is lacking** (see Box II).

4. With regard to the **title**,

☒ the text is approved as submitted by the applicant.

☐ the text has been established by this Authority to read as follows:

5. With regard to the **abstract**,

☒ the text is approved as submitted by the applicant.

☐ the text has been established, according to Rule 38.2(b), by this Authority as it appears in Box III. The applicant may, within one month from the date of mailing of this international search report, submit comments to this Authority.

6. The figure of the **drawings** to be published with the abstract is Figure No.

☒ as suggested by the applicant.

☐ because the applicant failed to suggest a figure.

☐ because this figure better characterizes the invention.

11

☐ None of the figures.



DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int.Cl.7)
X A	EP 0 467 437 A (ESAOTE BIOMEDICA SPA) 22 January 1992 (1992-01-22)  * page 4, line 23 - line 33 * * page 11, line 53 - page 16, line 8 * * figure 13 *	1-6, 11-16 7-10, 15	G01R33/383 H01F7/02
A	M.G. ABELE, J.H. JENSEN: "Hybrid pole pieces for permanent magnets" JOURNAL OF APPLIED PHYSICS, vol. 79, 1996, pages 5199-5201, XP000695732 * the whole document *	1-16	
A	P. KONZBUL, K. SVEDA: "Shim coils for NMR and MRI solenoid magnets" MEASUREMENT SCIENCE AND TECHNOLOGY, vol. 6, 1995, pages 1116-1123, XP000525063 ISSN: 0957-0233 * the whole document *	1-16	
A	WO 93 04493 A (BRITISH TECHNOLOGY GROUP USA) 4 March 1993 (1993-03-04) * page 5, paragraph 3 - page 6, paragraph 2 * * page 15, paragraph 2 - page 18, paragraph 2 * D & EP 0 601 101 A	1-16	TECHNICAL FIELDS SEARCHED (Int.Cl.7)  G01R H01F
The present search report has been drawn up for all claims			
Place of search THE HAGUE		Date of completion of the search 17 March 2000	Examiner Volmer, W
CATEGORY OF CITED DOCUMENTS			
X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document		T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons  & : member of the same patent family, corresponding document	

## INTERNATIONAL SEARCH REPORT

International Application No

PCT/GB 00/03905

## A. CLASSIFICATION OF SUBJECT MATTER

IPC 7 G01R33/383 H01F7/02

According to International Patent Classification (IPC) or to both national classification and IPC

## B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC 7 G01R H01F

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

INSPEC, WPI Data, PAJ

## C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X A	EP 0 467 437 A (ESAOTE BIOMEDICA SPA) 22 January 1992 (1992-01-22)  page 4, line 23 - line 33 page 11, line 53 -page 16, line 8 figure 13	1-6, 11-16 7-10,15
A	M.G. ABELE, J.H. JENSEN: "Hybrid pole pieces for permanent magnets" JOURNAL OF APPLIED PHYSICS, vol. 79, 1996, pages 5199-5201, XP000695732 the whole document	1-16

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☒ Further documents are listed in the continuation of box C.☒ Patent family members are listed in annex.

## \* Special categories of cited documents:

- \*A\* document defining the general state of the art which is not considered to be of particular relevance
- \*E\* earlier document but published on or after the international filing date
- \*L\* document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)
- \*O\* document referring to an oral disclosure, use, exhibition or other means
- \*P\* document published prior to the international filing date but later than the priority date claimed

- \*T\* later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
- \*X\* document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
- \*Y\* document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.
- \*G\* document member of the same patent family

Date of the actual completion of the international search

30 January 2001

Date of mailing of the international search report

06/02/2001

Name and mailing address of the ISA

European Patent Office, P.B. 5818 Patentlaan 2  
NL - 2280 HV Rijswijk  
Tel (+31-70) 340-2040, Tx. 31 651 epo nl,  
Fax: (+31-70) 340-3016

Authorized officer

Volmer, W

# INTERNATIONAL SEARCH REPORT

International Application No

PCT/GB 00/03905

## C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	P. KONZBUL, K. SVEDA: "Shim coils for NMR and MRI solenoid magnets" MEASUREMENT SCIENCE AND TECHNOLOGY, vol. 6, 1995, pages 1116-1123, XP000525063 ISSN: 0957-0233 the whole document	1-16
A	WO 93 04493 A (BRITISH TECHNOLOGY GROUP USA) 4 March 1993 (1993-03-04) page 5, paragraph 3 -page 6, paragraph 2 page 15, paragraph 2 -page 18, paragraph 2 & EP 0 601 101 A 15 June 1994 (1994-06-15) cited in the application	1-16

# INTERNATIONAL SEARCH REPORT

International Application No

PCT/GB 00/03905

Patent document cited in search report		Publication date	Patent family member(s)		Publication date
EP 467437	A	22-01-1992	IT	1247385 B	12-12-1994
			JP	5192309 A	03-08-1993
WO 9304493	A	04-03-1993	US	5266913 A	30-11-1993
			AU	658348 B	06-04-1995
			AU	2557692 A	16-03-1993
			CA	2115577 A	04-03-1993
			EP	0601101 A	15-06-1994
			JP	2997061 B	11-01-2000
			JP	7500223 T	05-01-1995



Application No: GB 9924833.8  
Claims searched: 1-10, 12-16

Examiner: Peter Emerson  
Date of search: 1 May 2000

## Patents Act 1977 Search Report under Section 17

### Databases searched:

UK Patent Office collections, including GB, EP, WO & US patent specifications, in:

UK Cl (Ed.R): G1N NG38B, NG38

Int Cl (Ed.7): G01R 33/383

Other: Online: WPI, JAPIO, EPODOC, INSPEC

### Documents considered to be relevant:

Category	Identity of document and relevant passage	Relevant to claims
A	Journal of Applied Physics, vol 79, no 8, pt 2A, pp5199-5201, April 1996, ABELE et al. 15	
A	IEEE Transactions on Magnetics, vol 25, no 5, pp3904-3906, Sept 1989, ABELE et al.	



X	Document indicating lack of novelty or inventive step	A	Document indicating technological background and/or state of the art
Y	Document indicating lack of inventive step if combined with one or more other documents of same category.	P	Document published on or after the declared priority date but before the filing date of this invention.
&	Member of the same patent family	E	Patent document published on or after, but with priority date earlier than, the filing date of this application.

# PATENT COOPERATION TREATY

## PCT

### INTERNATIONAL PRELIMINARY EXAMINATION REPORT

(PCT Article 36 and Rule 70)

Applicant's or agent's file reference <b>140058</b>	<b>FOR FURTHER ACTION</b> See Notification of Transmittal of International Preliminary Examination Report (Form PCT/IPEA/416)	
International application No. <b>PCT/GB00/03905</b>	International filing date (day/month/year) <b>11/10/2000</b>	Priority date (day/month/year) <b>20/10/1999</b>
International Patent Classification (IPC) or national classification and IPC <b>G01R33/383</b>		
Applicant <b>BTG INTERNATIONAL LIMITED et al.</b>		
<p>1. This international preliminary examination report has been prepared by this International Preliminary Examining Authority and is transmitted to the applicant according to Article 36.</p> <p>2. This REPORT consists of a total of 11 sheets, including this cover sheet.</p> <p><input type="checkbox"/> This report is also accompanied by ANNEXES, i.e. sheets of the description, claims and/or drawings which have been amended and are the basis for this report and/or sheets containing rectifications made before this Authority (see Rule 70.16 and Section 607 of the Administrative Instructions under the PCT).</p> <p>These annexes consist of a total of sheets.</p>		
<p>3. This report contains indications relating to the following items:</p> <ul style="list-style-type: none"> <li>I <input checked="" type="checkbox"/> Basis of the report</li> <li>II <input type="checkbox"/> Priority</li> <li>III <input checked="" type="checkbox"/> Non-establishment of opinion with regard to novelty, inventive step and industrial applicability</li> <li>IV <input type="checkbox"/> Lack of unity of invention</li> <li>V <input checked="" type="checkbox"/> Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement</li> <li>VI <input type="checkbox"/> Certain documents cited</li> <li>VII <input type="checkbox"/> Certain defects in the international application</li> <li>VIII <input type="checkbox"/> Certain observations on the international application</li> </ul>		
Date of submission of the demand  <b>27/04/2001</b>	Date of completion of this report  <b>11.04.2002</b>	
Name and mailing address of the international preliminary examining authority:   <b>European Patent Office - P.B. 5818 Patentlaan 2 NL-2280 HV Rijswijk - Pays Bas Tel. +31 70 340 - 2040 Tx: 31 651 epo nl Fax: +31 70 340 - 3016</b>	Authorized officer  <b>Volmer, W</b>  Telephone No. +31 70 340 3516  	



**INTERNATIONAL PRELIMINARY  
EXAMINATION REPORT**

International application No. PCT/GB00/03905

**I. Basis of the report**

1. With regard to the **elements** of the international application (*Replacement sheets which have been furnished to the receiving Office in response to an invitation under Article 14 are referred to in this report as "originally filed" and are not annexed to this report since they do not contain amendments (Rules 70.16 and 70.17)*):

**Description, pages:**

1-18 as originally filed

**Claims, No.:**

1-16 as originally filed

**Drawings, sheets:**

1/9-9/9 as originally filed

2. With regard to the **language**, all the elements marked above were available or furnished to this Authority in the language in which the international application was filed, unless otherwise indicated under this item.

These elements were available or furnished to this Authority in the following language: , which is:

- ☐ the language of a translation furnished for the purposes of the international search (under Rule 23.1(b)).
- ☐ the language of publication of the international application (under Rule 48.3(b)).
- ☐ the language of a translation furnished for the purposes of international preliminary examination (under Rule 55.2 and/or 55.3).

3. With regard to any **nucleotide and/or amino acid sequence** disclosed in the international application, the international preliminary examination was carried out on the basis of the sequence listing:

- ☐ contained in the international application in written form.
- ☐ filed together with the international application in computer readable form.
- ☐ furnished subsequently to this Authority in written form.
- ☐ furnished subsequently to this Authority in computer readable form.
- ☐ The statement that the subsequently furnished written sequence listing does not go beyond the disclosure in the international application as filed has been furnished.
- ☐ The statement that the information recorded in computer readable form is identical to the written sequence listing has been furnished.

4. The amendments have resulted in the cancellation of:

- ☐ the description, pages:
- ☐ the claims, Nos.:

**INTERNATIONAL PRELIMINARY  
EXAMINATION REPORT**

International application No. PCT/GB00/03905

☐ the drawings, sheets:

5. ☐ This report has been established as if (some of) the amendments had not been made, since they have been considered to go beyond the disclosure as filed (Rule 70.2(c)):

*(Any replacement sheet containing such amendments must be referred to under item 1 and annexed to this report.)*

6. Additional observations, if necessary:

**III. Non-establishment of opinion with regard to novelty, inventive step and industrial applicability**

1. The questions whether the claimed invention appears to be novel, to involve an inventive step (to be non-obvious), or to be industrially applicable have not been examined in respect of:

☐ the entire international application.

☒ claims Nos. 15.

because:

☐ the said international application, or the said claims Nos. relate to the following subject matter which does not require an international preliminary examination (*specify*):

☒ the description, claims or drawings (*indicate particular elements below*) or said claims Nos. are so unclear that no meaningful opinion could be formed (*specify*):  
**see separate sheet**

☐ the claims, or said claims Nos. are so inadequately supported by the description that no meaningful opinion could be formed.

☐ no international search report has been established for the said claims Nos. .

2. A meaningful international preliminary examination cannot be carried out due to the failure of the nucleotide and/or amino acid sequence listing to comply with the standard provided for in Annex C of the Administrative Instructions:

☐ the written form has not been furnished or does not comply with the standard.

☐ the computer readable form has not been furnished or does not comply with the standard.

**V. Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement**

1. Statement

Novelty (N)

Yes: Claims 7-10

**INTERNATIONAL PRELIMINARY  
EXAMINATION REPORT**

International application No. PCT/GB00/03905

	No:	Claims	1-6, 11-14; 16
Inventive step (IS)	Yes:	Claims	
	No:	Claims	1-14, 16
Industrial applicability (IA)	Yes:	Claims	1-14, 16
	No:	Claims	

2. Citations and explanations  
**see separate sheet**

**INTERNATIONAL PRELIMINARY  
EXAMINATION REPORT - SEPARATE SHEET**

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International application No. PCT/GB00/03905

**Re Item I**

**Basis of the report**

**INTERNATIONAL PRELIMINARY  
EXAMINATION REPORT - SEPARATE SHEET**

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International application No. PCT/GB00/03905

**Re Item III**

**Non-establishment of opinion with regard to novelty, inventive step and industrial applicability**

Claim 15 refers to Fourier Kernel space. Since an unambiguous definition of this space is not given in the claim, a further examination of claim 15 was not possible.

**R Item V**

**Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement**

The following document is mentioned for the first time in this International Preliminary Examination Report; the numbering will be adhered to in the rest of the procedure:

D1: EP-A-0 467 437.

1. The present application does not satisfy the criterion set forth in Article 33(2) PCT because the subject-matter of claims 1 - 6, 11 - 14 and 16 is not new in respect of the prior art as defined in the regulations [Rule 64(1) - (3) PCT]:
  - 1.1 Document D1 discloses [cf. D1: page 11, line 53 - page 16, line 8 and fig. 1]:
    - a method of designing a permanent magnetic structure for generating a desired magnetic field in a ROI comprising the steps of:
      - setting the dimensions of the permanent magnetic structure [in D1: a perfectly uniform field (of infinite length) is truncated, i.e. the dimensions of the structure are set];
      - setting a hypothetical distribution of magnetic material over the surface of said structure for each member of a finite set of spatial harmonics [see D1, page 13, lines 27 - 55];
      - calculating the amplitudes of said spatial harmonics [see D1: step 6b) on page 14];
      - scaling the members of the set of spatial harmonics according to the amplitudes of the spatial harmonics yielding the desired results [see D1: step 6b)];
      - establishing the required distribution of magnetic material by summing the scaled members and by minimizing the sum of least squares of the deviations over the ROI [see D1: page 14, steps 6c) and 6d). The step of minimizing the sum of least squares of the deviations over the ROI is a routine step in numerical optimization and can be derived directly and unambiguously from the disclosure of D1 [cf. the PCT Preliminary Examination Guidelines C-IV, 7.2].].

Therefore, the subject-matter of claims 1 and 11 is not new.

The above arguments apply mutatis mutandis to the permanent magnetic structure that has been designed according to the method steps disclosed in D1, and therefore also the subject-matter of claim 16 is not new.

Furthermore also in the D1-method, the desired field represents a modification of an existing

magnetic field, i.e. the modification of the existing field generated by a magnetic structure that has already been truncated but does not provide the desired results of homogeneity, which may always be expressed as one of the spatial harmonics of the magnetic field over the ROI, which spatial harmonics are evaluated in a "real" space, i.e. the space corresponding to the ROI.

Therefore also the subject-matter of claims 2 - 4 and 14 is not new.

D1 discloses [cf. pages 9 and 10: "Magnetic material characteristics"] that the material that is used in the optimization procedure has a strong impact on the results and the final performances obtained. Furthermore, D1 discloses that the inhomogeneity of the magnetic field can best be described by spatial harmonics. In the D1-method of optimizing magnetic material is added or modified to cancel certain terms related to the inhomogeneity; in other words, each harmonic results in shim [magnetic material that is added or modified] or the modification of a shim and a set of shims is created in order to cancel certain harmonic terms, i.e. the set is representative of the weighted sum of the individual harmonics. Therefore, also the subject-matter of claim 5 is not new.

In D1, the desired magnetic field is produced by a distribution of magnetic material over one or more flat surfaces, see D1, fig.1. Therefore also the subject-matter of claim 6 is not new.

Moreover, also in D1 the optimization procedure uses the standard step of incorporating an additional, arbitrary distribution of magnetic material in the next step of optimization. Therefore also the subject-matter of claim 12 is not new.

As is furthermore apparent from D1, also in the D1-method the usual steps of a numerical optimization method are carried out, i.e. an approximation to the desired field in the ROI produced by a distribution of magnetic material is calculated including the determination of the field by taking into account the thickness and placement of the magnetic material and this distribution of magnetic material is optimized, in other words, a corrected distribution of magnetic material is established in accordance with the difference of the resultant field and the desired field, and these steps are repeated until the difference between the desired and the resulting field becomes sufficiently small. Therefore, also the subject-matter of claim 13 is not new.

**INTERNATIONAL PRELIMINARY  
EXAMINATION REPORT - SEPARATE SHEET**

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International application No. PCT/GB00/03905

The present application does not satisfy the criterion set forth in Article 33(3) PCT because the subject-matter of claims 7 - 10 does not involve an inventive step [Rule 65(1) and (2) PCT]:

D1 discloses the optimization of magnetic material that is distributed over a polygonal cylindrical shell, see D1, fig. 1. The step of optimizing magnetic material distributed over an elliptical or a circular cylindrical shell is a straightforward idealization of real shells that are used in permanent magnet design, and the step of carrying out the D1-calculations is also straightforward for the person skilled in the design of permanent magnets. Therefore, the subject-matter of claims 7 and 8 lacks an inventive step.

D1 discloses a permanent magnet of a polygonal cylindrical structure, see D1, fig. 13. Varying the thickness of the magnetic material used in such a structure, e.g. in an azimuthal direction thereof, is a straightforward solution to the problem of cancelling certain inhomogeneity-related terms.

Also the combination of paramagnetic and diamagnetic materials is a straightforward solution to adjusting the homogeneity of the magnetic field.

Therefore, also the subject-matter of claims 9 and 10 lacks an inventive step.



**INTERNATIONAL PRELIMINARY  
EXAMINATION REPORT - SEPARATE SHEET**

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International application No. PCT/GB00/03905

**Re Item VII**

**Certain defects in the international application**

To meet the requirements of Rule 5.1(a)(ii) PCT, the document D1 should have been identified in the description and the relevant background art disclosed therein should have been briefly discussed.

To meet the requirements of Rule 29(1) EPC, the independent claims should have been properly cast in the two part form, with those features which in combination are part of the prior art [see document D1] being placed in the preamble.

The subject-matter of claim 13 is defined by a reference to the description ["in accordance with the method described herein ..."]. According to the PCT Preliminary Examination Guidelines, C-III, 4.10, such a claim is allowable only where the reference is absolutely necessary. Such is, however, not the case here. Therefore, claim 13 should have been amended or should have been deleted. This reference to the description has been ignored in Section V above.

On page 2, lines 5 - 10, reference is made to the prior art published in EP-A-0 601 101 and its equivalent US-A-5 266 913, "the disclosure of which is incorporated by reference". It is not clear whether this expression is a reference to the background art, or whether it is part of the disclosure of the invention [cf. the PCT Preliminary Examination Guidelines C-II, 4.17]. Therefore, this expression should have been deleted.

**INTERNATIONAL PRELIMINARY  
EXAMINATION REPORT - SEPARATE SHEET**

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International application No. PCT/GB00/03905

**Re It m VIII**

**C rtain observations on th international application**

In addition to the objections of Sections V and VII above, the application does not meet the requirements of Article 6 PCT for the following reasons:

The various definitions of the invention given in independent claims 1 and 11 are such that the claims as a whole are not concise, contrary to Article 6 PCT. The claims should have been recast to include only the minimum necessary number of independent claims in any one category with dependent claims as appropriate [Rule 6.4 (a)-(c) PCT]. In the present case, it is considered appropriate to use only one independent claim in any category.

The following terms or expressions used in the claims are vague and indefinite and, as such, render the scope of the claims unclear; accordingly, the claims should have been amended to remove these defects [Article 6 PCT]:

- optimum approximation to the desired field [claim 1 and claim 13: Does this absolute definition preclude future developments and future amendments?];
- an additional, hypothetical, arbitrary distribution of magnetic material into said set [claim 12: A set of magnetic material is not defined in claim 1].

D 10 APR 2002

WIPO

PCT

## INTERNATIONAL PRELIMINARY EXAMINATION REPORT

(PCT Article 36 and Rule 70)



Applicant's or agent's file reference 140058	<b>FOR FURTHER ACTION</b> See Notification of Transmittal of International Preliminary Examination Report (Form PCT/IPEA/416)	
International application No. PCT/GB00/03905	International filing date (day/month/year) 11/10/2000	Priority date (day/month/year) 20/10/1999
International Patent Classification (IPC) or national classification and IPC G01R33/383		
Applicant BTG INTERNATIONAL LIMITED et al.		

1. This international preliminary examination report has been prepared by this International Preliminary Examining Authority and is transmitted to the applicant according to Article 36.
2. This REPORT consists of a total of 11 sheets, including this cover sheet.  
  
☐ This report is also accompanied by ANNEXES, i.e. sheets of the description, claims and/or drawings which have been amended and are the basis for this report and/or sheets containing rectifications made before this Authority (see Rule 70.16 and Section 607 of the Administrative Instructions under the PCT).

These annexes consist of a total of sheets.

3. This report contains indications relating to the following items:

- I ☒ Basis of the report
- II ☐ Priority
- III ☒ Non-establishment of opinion with regard to novelty, inventive step and industrial applicability
- IV ☐ Lack of unity of invention
- V ☒ Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement
- VI ☐ Certain documents cited
- VII ☒ Certain defects in the international application
- VIII ☒ Certain observations on the international application

Date of submission of the demand  27/04/2001	Date of completion of this report  11.04.2002
Name and mailing address of the international preliminary examining authority:   European Patent Office - P.B. 5818 Patentlaan 2 NL-2280 HV Rijswijk - Pays Bas Tel. +31 70 340 - 2040 Tx: 31 651 epo nl Fax: +31 70 340 - 3016	Authorized officer  Volmer, W  Telephone No. +31 70 340 3516  

# INTERNATIONAL PRELIMINARY EXAMINATION REPORT

International application No. PCT/GB00/03905

## I. Basis of the report

1. With regard to the **elements** of the international application (*Replacement sheets which have been furnished to the receiving Office in response to an invitation under Article 14 are referred to in this report as "originally filed" and are not annexed to this report since they do not contain amendments (Rules 70.16 and 70.17)*):

### Description, pages:

1-18 as originally filed

### Claims, No.:

1-16 as originally filed

### Drawings, sheets:

1/9-9/9 as originally filed

2. With regard to the **language**, all the elements marked above were available or furnished to this Authority in the language in which the international application was filed, unless otherwise indicated under this item.

These elements were available or furnished to this Authority in the following language: , which is:

- ☐ the language of a translation furnished for the purposes of the international search (under Rule 23.1(b)).
- ☐ the language of publication of the international application (under Rule 48.3(b)).
- ☐ the language of a translation furnished for the purposes of international preliminary examination (under Rule 55.2 and/or 55.3).

3. With regard to any **nucleotide and/or amino acid sequence** disclosed in the international application, the international preliminary examination was carried out on the basis of the sequence listing:

- ☐ contained in the international application in written form.
- ☐ filed together with the international application in computer readable form.
- ☐ furnished subsequently to this Authority in written form.
- ☐ furnished subsequently to this Authority in computer readable form.
- ☐ The statement that the subsequently furnished written sequence listing does not go beyond the disclosure in the international application as filed has been furnished.
- ☐ The statement that the information recorded in computer readable form is identical to the written sequence listing has been furnished.

4. The amendments have resulted in the cancellation of:

- ☐ the description, pages:
- ☐ the claims, Nos.:

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☐ the drawings, sheets:

5. ☐ This report has been established as if (some of) the amendments had not been made, since they have been considered to go beyond the disclosure as filed (Rule 70.2(c)):

*(Any replacement sheet containing such amendments must be referred to under item 1 and annexed to this report.)*

6. Additional observations, if necessary:

**III. Non-establishment of opinion with regard to novelty, inventive step and industrial applicability**

1. The questions whether the claimed invention appears to be novel, to involve an inventive step (to be non-obvious), or to be industrially applicable have not been examined in respect of:

☐ the entire international application.

☒ claims Nos. 15.

because:

☐ the said international application, or the said claims Nos. relate to the following subject matter which does not require an international preliminary examination (*specify*):

☒ the description, claims or drawings (*indicate particular elements below*) or said claims Nos. are so unclear that no meaningful opinion could be formed (*specify*):  
**see separate sheet**

☐ the claims, or said claims Nos. are so inadequately supported by the description that no meaningful opinion could be formed.

☐ no international search report has been established for the said claims Nos. .

2. A meaningful international preliminary examination cannot be carried out due to the failure of the nucleotide and/or amino acid sequence listing to comply with the standard provided for in Annex C of the Administrative Instructions:

☐ the written form has not been furnished or does not comply with the standard.

☐ the computer readable form has not been furnished or does not comply with the standard.

**V. Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement**

1. Statement

Novelty (N)

Yes: Claims 7-10

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	No:	Claims	1-6, 11-14, 16
Inventive step (IS)	Yes:	Claims	
	No:	Claims	1-14, 16
Industrial applicability (IA)	Yes:	Claims	1-14, 16
	No:	Claims	

2. Citations and explanations  
see separate sheet

**VII. Certain defects in the international application**

The following defects in the form or contents of the international application have been noted:  
see separate sheet

**VIII. Certain observations on the international application**

The following observations on the clarity of the claims, description, and drawings or on the question whether the claims are fully supported by the description, are made:

see separate sheet

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**Re l t m l**

**Basis of th report**

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**R Item III**

**Non- establishment of opinion with regard to novelty, inventive step and industrial applicability**

Claim 15 refers to Fourier Kernel space. Since an unambiguous definition of this space is not given in the claim, a further examination of claim 15 was not possible.



**Re Item V**

**Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement**

The following document is mentioned for the first time in this International Preliminary Examination Report; the numbering will be adhered to in the rest of the procedure:

D1: EP-A-0 467 437.

1. The present application does not satisfy the criterion set forth in Article 33(2) PCT because the subject-matter of claims 1 - 6, 11 - 14 and 16 is not new in respect of the prior art as defined in the regulations [Rule 64(1) - (3) PCT]:
  - 1.1 Document D1 discloses [cf. D1: page 11, line 53 - page 16, line 8 and fig. 1]:
    - a method of designing a permanent magnetic structure for generating a desired magnetic field in a ROI comprising the steps of:
      - setting the dimensions of the permanent magnetic structure [in D1: a perfectly uniform field (of infinite length) is truncated, i.e. the dimensions of the structure are set];
      - setting a hypothetical distribution of magnetic material over the surface of said structure for each member of a finite set of spatial harmonics [see D1, page 13, lines 27 - 55];
      - calculating the amplitudes of said spatial harmonics [see D1: step 6b) on page 14];
      - scaling the members of the set of spatial harmonics according to the amplitudes of the spatial harmonics yielding the desired results [see D1: step 6b)];
      - establishing the required distribution of magnetic material by summing the scaled members and by minimizing the sum of least squares of the deviations over the ROI [see D1: page 14, steps 6c) and 6d). The step of minimizing the sum of least squares of the deviations over the ROI is a routine step in numerical optimization and can be derived directly and unambiguously from the disclosure of D1 [cf. the PCT Preliminary Examination Guidelines C-IV, 7.2].].

Therefore, the subject-matter of claims 1 and 11 is not new.

The above arguments apply mutatis mutandis to the permanent magnetic structure that has been designed according to the method steps disclosed in D1, and therefore also the subject-matter of claim 16 is not new.

Furthermore also in the D1-method, the desired field represents a modification of an existing

magnetic field, i.e. the modification of the existing field generated by a magnetic structure that has already been truncated but does not provide the desired results of homogeneity, which may always be expressed as one of the spatial harmonics of the magnetic field over the ROI, which spatial harmonics are evaluated in a "real" space, i.e. the space corresponding to the ROI.

Therefore also the subject-matter of claims 2 - 4 and 14 is not new.

D1 discloses [cf. pages 9 and 10: "Magnetic material characteristics"] that the material that is used in the optimization procedure has a strong impact on the results and the final performances obtained. Furthermore, D1 discloses that the inhomogeneity of the magnetic field can best be described by spatial harmonics. In the D1-method of optimizing magnetic material is added or modified to cancel certain terms related to the inhomogeneity; in other words, each harmonic results in shim [magnetic material that is added or modified] or the modification of a shim and a set of shims is created in order to cancel certain harmonic terms, i.e. the set is representative of the weighted sum of the individual harmonics. Therefore, also the subject-matter of claim 5 is not new.

In D1, the desired magnetic field is produced by a distribution of magnetic material over one or more flat surfaces, see D1, fig.1. Therefore also the subject-matter of claim 6 is not new.

Moreover, also in D1 the optimization procedure uses the standard step of incorporating an additional, arbitrary distribution of magnetic material in the next step of optimization. Therefore also the subject-matter of claim 12 is not new.

As is furthermore apparent from D1, also in the D1-method the usual steps of a numerical optimization method are carried out, i.e. an approximation to the desired field in the ROI produced by a distribution of magnetic material is calculated including the determination of the field by taking into account the thickness and placement of the magnetic material and this distribution of magnetic material is optimized, in other words, a corrected distribution of magnetic material is established in accordance with the difference of the resultant field and the desired field, and these steps are repeated until the difference between the desired and the resulting field becomes sufficiently small. Therefore, also the subject-matter of claim 13 is not new.

The present application does not satisfy the criterion set forth in Article 33(3) PCT because the subject-matter of claims 7 - 10 does not involve an inventive step [Rule 65(1) and (2) PCT]:

D1 discloses the optimization of magnetic material that is distributed over a polygonal cylindrical shell, see D1, fig. 1. The step of optimizing magnetic material distributed over an elliptical or a circular cylindrical shell is a straightforward idealization of real shells that are used in permanent magnet design, and the step of carrying out the D1-calculations is also straightforward for the person skilled in the design of permanent magnets. Therefore, the subject-matter of claims 7 and 8 lacks an inventive step.

D1 discloses a permanent magnet of a polygonal cylindrical structure, see D1, fig. 13. Varying the thickness of the magnetic material used in such a structure, e.g. in an azimuthal direction thereof, is a straightforward solution to the problem of cancelling certain inhomogeneity-related terms.

Also the combination of paramagnetic and diamagnetic materials is a straightforward solution to adjusting the homogeneity of the magnetic field.

Therefore, also the subject-matter of claims 9 and 10 lacks an inventive step.

**Re Item VII**

**Certain defects in the international application**

To meet the requirements of Rule 5.1(a)(ii) PCT, the document D1 should have been identified in the description and the relevant background art disclosed therein should have been briefly discussed.

To meet the requirements of Rule 29(1) EPC, the independent claims should have been properly cast in the two part form, with those features which in combination are part of the prior art [see document D1] being placed in the preamble.

The subject-matter of claim 13 is defined by a reference to the description ["in accordance with the method described herein ..."]. According to the PCT Preliminary Examination Guidelines, C-III, 4.10, such a claim is allowable only where the reference is absolutely necessary. Such is, however, not the case here. Therefore, claim 13 should have been amended or should have been deleted. This reference to the description has been ignored in Section V above.

On page 2, lines 5 - 10, reference is made to the prior art published in EP-A-0 601 101 and its equivalent US-A-5 266 913, "the disclosure of which is incorporated by reference". It is not clear whether this expression is a reference to the background art, or whether it is part of the disclosure of the invention [cf. the PCT Preliminary Examination Guidelines C-II, 4.17]. Therefore, this expression should have been deleted.

**Re It m VIII**

**Certain observations on the international application**

In addition to the objections of Sections V and VII above, the application does not meet the requirements of Article 6 PCT for the following reasons:

The various definitions of the invention given in independent claims 1 and 11 are such that the claims as a whole are not concise, contrary to Article 6 PCT. The claims should have been recast to include only the minimum necessary number of independent claims in any one category with dependent claims as appropriate [Rule 6.4 (a)-(c) PCT]. In the present case, it is considered appropriate to use only one independent claim in any category.

The following terms or expressions used in the claims are vague and indefinite and, as such, render the scope of the claims unclear; accordingly, the claims should have been amended to remove these defects [Article 6 PCT]:

- optimum approximation to the desired field [claim 1 and claim 13: Does this absolute definition preclude future developments and future amendments?];
- an additional, hypothetical, arbitrary distribution of magnetic material into said set [claim 12: A set of magnetic material is not defined in claim 1].